# Climatological Data for December, 1909.
## DISTRICT No. 5, UPPER MISSISSIPPI VALLEY.

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### TEMPERATURE.

December, 1909, will be noted for its low average temperature, its cloudiness, the frequency of snowstorms and the long period of good sleighing. The temperature was below the normal in all sections of the district, every station reporting a deficiency and a minimum of zero or below, except Cairo, Ill. The deficiency was, however, caused by continuous moderately low temperature rather than by a few extremely low minima. Over the larger part of the district it was the coldest December during the past 20 years or more. The mean temperature for that portion of North Dakota within this district was 4.4°, or 6.3° below the normal. Nearly normal temperature prevailed during the first 2 and the last 3 days of the month, and the maxima for the month were invariably recorded during 1 of those 5 days. During the remainder of the month the temperature was decidedly below the normal. The first and third decades were the coldest, the minimum temperature for the month being recorded generally on the 9th. The highest temperature, 52°, was recorded at Forman on the 1st, and the lowest, −42°, was recorded at Cando on the 9th.

In Minnesota the average temperature was 9.8°, or 6.1° below the normal, and 7.5° lower than the average for 1908.

The month was as cold as December, 1903, which was the coldest December on record previous to the past month. The mean temperature ranged from 14.0°, or slightly higher, in Nicollet, eastern Winona, and eastern Houston counties to 2.0° in Kittson County. The deficiency in temperature was general, and ranged from 5° to 7° in the south and northwest to about 1° in the extreme northeastern counties. Warm weather prevailed from the 1st to the 5th, followed by steady cold weather the rest of the month. The 1st was generally the warmest day and the 29th the coldest. The highest temperature recorded was 58° at Saint Peter on the 2d, and the lowest, −39° at Warroad on the 9th.

The month was one of the coldest on record in Wisconsin. During the first 5 days the temperature was comparatively high, but a change to cooler occurred on the 5th, and for the remainder of the month the temperatures remained below freezing at nearly all stations, and the minimum was below zero on many days. The mean temperature was about 7° below the normal over the southern half of the State, and about 4° below normal over the northern half. The maxima for the month occurred at most stations on the 1st and 2d, and the minima on the 18th and 29th.

It was the coldest December in Iowa since State-wide observations began in 1890, and probably the coldest since 1876. The average temperature for the State was 12.1° lower than the average for December, 1908, and 2°9° lower than for any other December since 1890. The monthly minima were not, however, as low as in 1892, 1901, and 1903, but the weather was continuously cold from the 5th to the 30th, inclusive. The first 4 days were moderate, with maximum temperatures from 45° to 60° on the 2d, which was the warmest day of the month. A cold wave passed over the State on the 5th, and from that date to the 30th the maximum temperatures were below the freezing point, except on 1 or 2 days, and the minimum temperatures were near or below zero. At many stations, the minimum temperature was below zero on a greater number of days than was ever before recorded during the month of December. The lowest temperature was recorded on the 29th, except in the extreme southeastern counties, where the minimum occurred on the 30th.

In Missouri it was the coldest December in the past two decades or more; the mean temperature being continuously below the normal from the 5th to the 30th, inclusive, and the average daily deficiency was about 9° per day. The mildest period of the month was from the 1st to the 14th, when the day temperatures ranged from 50° to 65°. There were 4 periods during the month when the minimum temperatures were zero or below, viz: 8–9th, 18–19th, 26th, and 29–30th. The minimum temperatures were generally within the limits of previous extremes, and the number of days with zero temperature ranged from 7 to 10.

In Indiana the mean temperature was much below the normal, and it was the coldest December since records for the State began. The month opened with very mild weather, but a cold wave overspread the State on the 5th and 6th, giving temperatures below zero from the 8th to the 10th. The weather then continued uniformly cold during the remainder of the month, it being above normal on only 2 or 3 days during that time. The severest cold weather occurred near the close of the month, when minimum temperatures of −10° to −13° were recorded throughout both the Kankakee and Iroquois valleys on the 30th.

The average temperature in Illinois was 20.6°, or about 8.5° below the normal. Not since 1880 has the mean temperature for December been so low as it was during the past month. The average number of days on which the minimum temperature was 32° or lower was 27, and the average number of days with zero temperature or lower was 7. The warm, mild temperatures of the previous month continued until the 5th, when there was a sudden and decided change to severe winter conditions, which continued to the close of the month.

The monthly mean temperature for the district, as shown by the records of 289 stations, was 14.3°, which is 7.3° below the normal. The highest monthly mean was 31.0° at Cairo, Ill., and the lowest −1.6°, at Pembina, N. Dak. The highest temperature reported was 72° at Cairo, Ill., on the 4th, and the lowest, −42° at Condo, N. Dak., on the 9th.

### PRECIPITATION.

The precipitation was generally above the normal and after the 5th nearly if not all of it fell in the form of snow. The snowstorms were frequent, but the amounts of snowfall were mostly small, except on the 24–25th, when the fall was heavy over the larger part of the district, and, owing to the continuous cold weather, most of the snow remained on the ground until the close of the month, making an unusually long period of good sleighing for December.

In North Dakota the average precipitation was 1.44 inches, or .87 inch more than the normal. With the exception of the precipitation on the 1st and 2d, all of it was in the form of snow. The average snowfall for the district was 12.4 inches. As a result of the heavy snow and accompanying low temperature, considerable delay was caused to railroad traffic and much difficulty was encountered in efforts to open the highways. There was also much suffering of live stock on account of crusted snow and intense cold weather. All elements considered, the weather during the month was the severest in the history of the Climatological Service of the State. Much snow remained on the ground at the close of the month.

The precipitation was twice as heavy in Minnesota as in December, 1908, and the heaviest on record with the single exception of December, 1902, when the average was 1.79 inches. The average for the past month was 1.52 inches. Quite general rains fell on the first 4 days, followed by general and heavy snowfall on the 5th. General and more or less heavy snows fell on the 11th, 16th, 20th, and 27th. The snowfall was unusually heavy. The ground was covered from the 5th to the end of the month to a depth of 5 to 15 inches; but there was

very little frost in the ground under the deep snow, a condition that has seriously interfered with logging in the northern woods and field work in the southern and western portions of the State.

In Wisconsin the precipitation was quite unevenly distributed over the section, but was fairly well distributed throughout the month. In the central and southern counties the total was very nearly the normal amount, but in most of the northern counties it was only a little above one-half the normal. After the 5th practically all of the precipitation was in the form of snow. The severest storm of the month occurred on the 24–25th, when the snow drifted badly and traffic was interrupted to a considerable extent. The ground was partially covered with snow from the 5th to the 11th, and completely covered after the latter date, the depth on the ground gradually increasing until the end of the month.

The average precipitation for Iowa within the district was 2.35 inches, or 1.09 inch above the normal, and has been exceeded in December only twice during the past 20 years. Rains were general from the 1st to 3d, changing to snow in the northern counties on the latter date. The rain changed to sleet over the southern and eastern counties on the 4th, changing to snow on the 5th. After the 5th snow fell at frequent intervals, but the daily amounts were not large, except on the 24–25th, when the amounts ranged from 2 to 12 inches, the largest amounts being reported from the central and east-central counties. At least a trace of precipitation fell at some station in the section on every day of the month, except the 31st; and the number of days with .01 inch or more of precipitation exceeded all former records for December at several stations. The average snowfall for the month was 14.3 inches. The ground was covered from the 3d in the northern and the 5th in southern and eastern counties to the close of the month, and there was a longer period of good sleighing than for many years so early in the winter.

In Missouri the total precipitation ranged from 2 to 6 inches, exceeding the normal by 1 inch to 4 inches. The periods of general precipitation were from the 1st to the 5th, 11–12th, and 24–25th. After the 5th all precipitation was in the form of snow or sleet. The snowfall was more or less general and heavy on the 6–7th, 24–25th, and 29th. The total fall ranged from 7 to over 13 inches, and covered the ground continuously from the 6th to the close of the month.

The precipitation was well distributed in Indiana during the month, and much the greater part fell in the form of snow. On account of the continuous cold weather, a considerable quantity of snow remained on the ground during the latter part of the month; the amount remaining on the ground on the 31st ranged from 7.5 to 14 inches. A fall of about 5 inches of snow occurred on the 7th, and 8 to 12 inches fell on the 24–25th, which caused some delay to railroad traffic, although not to a serious extent.

In Illinois the average precipitation was 2.99 inches, or 0.89 inch above the normal. Rain or snow, in measurable quantities, fell somewhere in the State on 21 days. The greatest monthly amount, 5.27 inches, occurred at Sycamore, and the least, 1.21 inches at Greggsville. The greatest amount in 24 consecutive hours was 2.32 inches at Riley on the 5th, which was the heaviest rainfall in winter at that place since 1880. The average snowfall was 16.4 inches, which was quite heavy as compared with previous records for December.

The average precipitation for the district, as shown by the records of 297 stations, was 2.20 inches, which is 0.96 inch above the normal. The greatest amount, 6.17 inches, occurred at Sublett Mo., and the least, 0.30 inch, at Dunseith, N. Dak. The greatest amount in 24 hours, 2.75 inches, occurred at Sublett, Mo., on the 4th. The average depth of snowfall was 14.4 inches; the greatest depth was at Sycamore, Ill., 32.5 inches, and the least, 1.0 inch at Cairo, Ill. Measurable precipitation occurred on the average of 10 days.

*Sunshine and cloudiness.*—The average number of clear days was 8; party cloudy, 7; and cloudy, 16. The duration of sunshine was below normal.

*Wind.*—Northwest winds prevailed. The highest velocity reported was 42 miles per hour from the west at Hannibal, Mo.

### MISCELLANEOUS.

The heavy snow and the severe cold weather put a stop to the corn harvest. Much of the corn crop is still in the fields in Iowa and Minnesota, and a great deal of it is on the ground and covered by ice and snow. The heavy snow, however, afforded good protection and was favorable to the winter grains in the southern section of the district. Railroad and street car traffic was delayed considerably by the heavy snows, but over the larger part of the district the delays were temporary. Floating ice was reported in the Mississippi River on the 12th. An ice gorge wrecked the false work of the McKinley bridge, causing a considerable loss. At the close of the month the river was solidly gorged at St. Louis, Mo. Navigation between St. Louis and Cairo was suspended on the 18th. The transfer of passengers, etc., between Birdspoint, Mo., and Cairo, Ill., was at times suspended, and the passage was closed on the 30th.

The Des Moines River, at Des Moines, Ia., did not freeze over until the 20th, notwithstanding the fact that there had been a great deal of severely cold weather prior to that date. The stage of the river was unusually high for the season of the year during the fore part of the month, and as the heavy covering of snow prevented the ground from freezing, except on the surface, the temperature of the water flowing into the river was considerably above the freezing point, thereby requiring more than the usual amount of cold weather to reduce the temperature of the water in the river. The ice, however, was 9 to 10 inches thick at the close of the month, but the ice harvest has not yet begun, except on ponds.

### DRAINAGE NOTES.

The heavy snow and the severe cold weather put a stop to the construction of all drainage work, but the boards of supervisors in several counties in Iowa have been active in making plans for the resumption and extension of the work during the coming season. The boards of supervisors of Hardin, Franklin, Wright, and Hamilton counties, sitting in joint session, awarded the contract for the construction of a drainage ditch through the 4 counties above named for $59,000. The estimated yardage of the ditch is 1,000,000 cubic yards, and the length is 27 miles. Work is to be begun April 1, 1910, and completed by January 1, 1911.

### SANITARY DISTRICT OF CHICAGO.

Mr. E. H. Heilborn, Division Engineer, is making a topographic survey of the Illinois Valley for the sanitary district of Chicago, and he has in mind the construction of charts and diagrams to show the relation of precipitation to river stages at 40 regular stations along the Des Plaines and Illinois rivers.

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## THE EFFECT OF DRAINAGE WORK IN NORTHERN IOWA ON THE FLOOD STAGES OF THE RIVERS.

By A. MARSTON, C. E., Dean of Engineering and Professor of Civil Engineering, Iowa State College, Ames, Iowa.

The question is frequently asked, What effect will the extensive drainage work which has been in progress in northern Iowa for the past few years have on the flood stages of the rivers whose sources are in the territory drained?

The people living along the lower courses of these streams seem, very generally, to have the impression that, since the water is to be drained away from the upper portion of the drainage areas, the flood flow of the streams will be increased thereby, and hence greater damage done by flooding the bottom lands bordering the lower courses of these streams.